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INTRA-OVARIAL FRUITS IN *CARICA PAPAYA*

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(WITH SIX FIGURES)

An unusually interesting teratological phenomenon came to notice recently when in cutting open a fruit of papaya (*Carica Papaya* L.) five small secondary fruits were found within the seed cavity. Externally the fruit containing them was in no way

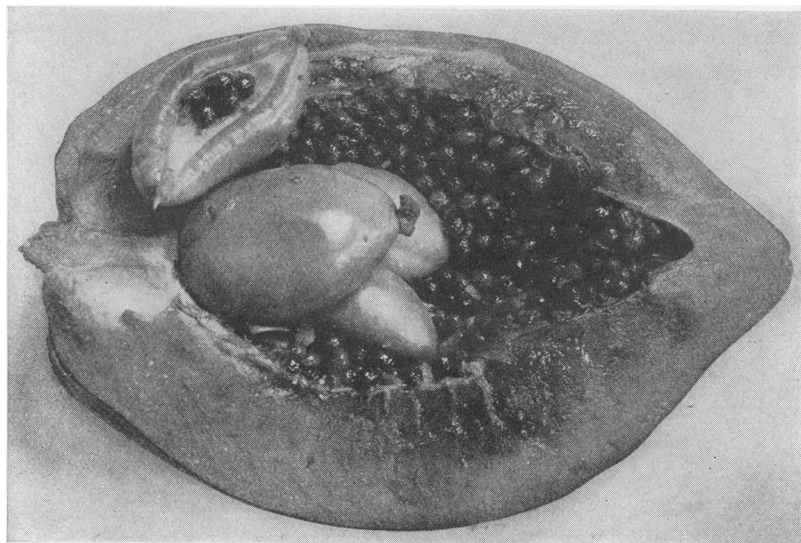


FIG. 1.—Papaya fruit cut longitudinally, showing seeds and secondary fruits in position; one secondary fruit turned over to show production of seeds; $\times \frac{2}{3}$.

different from any other specimen to indicate the presence of the secondary fruits. These were attached near the basal end of the fruit, growing out from the placenta and replacing the seeds. In addition to the four conspicuous fruits there was found also one very much smaller. Fig. 1 shows four of the inclosed fruits in situ. Only the style and stigma of the fourth, the smallest fruit, is visible.

Four of the five fruits consisted of an ovary surmounted by a sessile stigma. The ovary was not completely developed, in any case only a single carpel probably being represented. Each of the



FIG. 2.—Sketch of small secondary fruit only partly visible in fig. 1; natural size.

four larger inclosed fruits produced seeds. This may be seen from the figure, one of the fruits being placed to one side and turned over to show the incomplete development and the production of ovules. The stigmas, instead of being flattened and laciniate, as in normal fruits, were capitate, considerably swollen, spongy, and with tuberculate surface. The smallest

fruit has a very small ovary, without ovules, the capitate stigma being borne on an elongated style (fig. 2). The inclosed fruits were yellow, being somewhat paler than normal fruits.

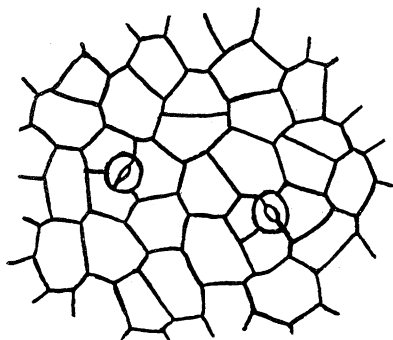


FIG. 3

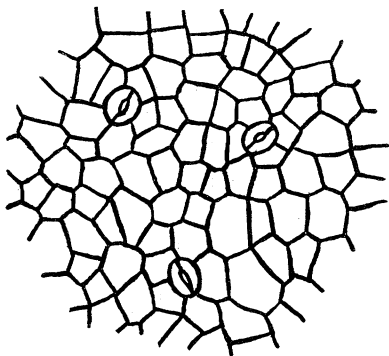


FIG. 4

FIGS. 3, 4.—Fig. 3, portion of epidermis of secondary fruit showing stomata; $\times 160$; fig. 4, portion of epidermis of normal fruit showing stomata; $\times 160$.

A microscopic examination of the epidermis of these fruits (fig. 3) showed it to be made up of cells similar in shape but somewhat larger than those of the epidermis of normal fruits (fig. 4). This similarity extended even to the presence of stomata. The guard cells were without chloroplasts. The only evident external difference in the epidermis of the inclosed fruits from that of normal fruits was in the absence of the coating of wax which the latter possesses in a marked degree. In cross-section the structure of the inclosed fruits resembles closely that of normal fruits, the

epidermis being thinner in the former. This and the absence of wax is probably due to the fact that they were not exposed. In all respects the seeds resemble those produced by a normal fruit. The embryo was found to be present in the several seeds examined, and to all appearances, so far as could be ascertained with a hand lens, was of normal form and size.

Some two or three months after finding these specimens, another set of intra-ovarial fruits of papaya was supplied to the writer through the kindness of Dr. L. O. KUNKEL, of the Hawaiian

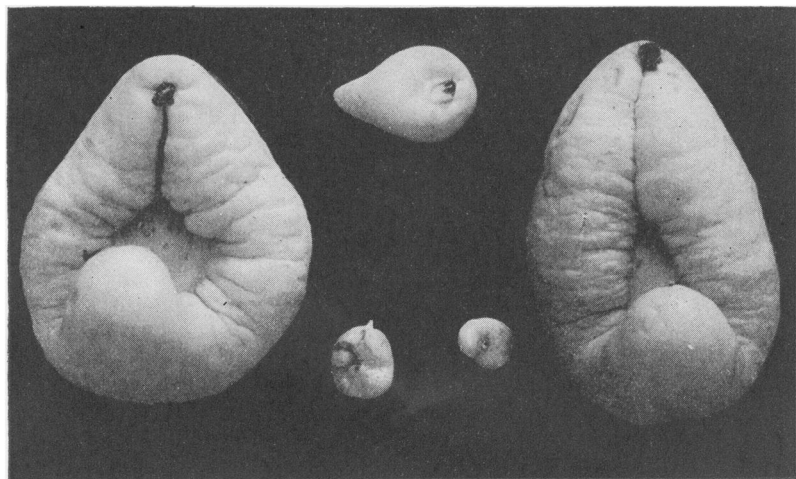


FIG. 5.—Secondary fruits from seed cavity of papaya; slightly reduced

Sugar Planters' Experiment Station. These are shown in fig. 5. Only two of them are comparable in form and size to those shown in fig. 1. These two were rough surfaced, as may be seen from the illustration. The lower one of the three middle specimens shown in fig. 5 differed in being turbinate and smooth surfaced. In cross-section it was circular, without a seed cavity, but having a single vascular bundle near the center. All five fruits in this case were a very light cream color. No matured seeds were found, although the two larger ones had a placental surface with a few rudimentary ovules. The styles of the larger ones were filiform, tipped by a very small capitate stigma. An examination of the epidermis of

three of the five specimens showed it to be similar to that figured for the other specimens (fig. 3).

These intra-ovarial fruits, although they occur on the placentae, cannot with certainty be regarded as metamorphosed ovules. Instead it is more probable that they were produced from buds which developed adventitiously in places which would normally be occupied by ovules. The occurrence of adventitious formations within the ovary replacing ovules has been observed by several botanists. MASTERS¹ figures and describes a silique of *Cheiranthus*

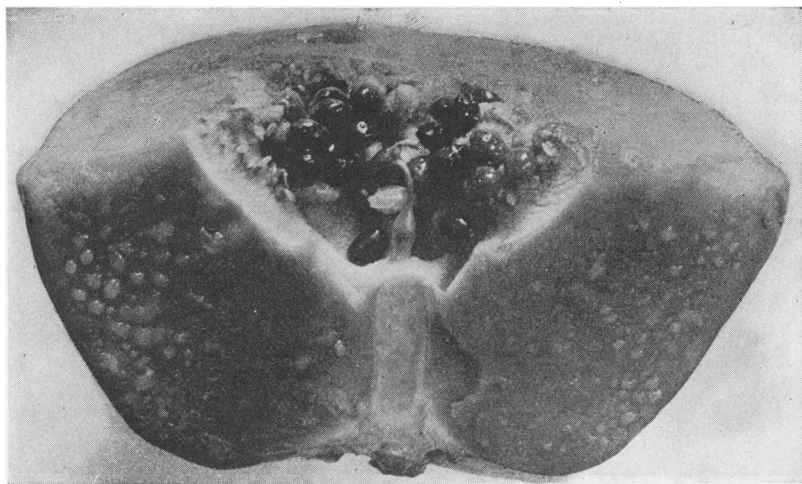


FIG. 6.—Portion of papaya fruit showing secondary pistil as proliferation of stem axis; $\times 1.25$.

Cheiri which contained an adventitious silique, replacing an ovule, within an ordinary silique, and also a grape which had another grape inside in the place of a seed. He also quotes and shows figures of a case described by BERKELEY² of a carnation in which the placentae bore both ovules and carpels. In this case transitional forms between the normal ovules and their carpellary transformations were found. Some of the carpels derived from ovules produced secondary ovules. MASTERS states that in the carnation

¹ MASTERS, M. T., Vegetable teratology. London. 1869.

² BERKELEY, M. J., Gardener's Chronicle, September 28, 1850 (p. 612).

specimens described by BERKELEY "the nucleus of the ovule was not developed." No transitional forms between ovules and secondary fruits such as were described by BERKELEY in the carnation were found in these papaya specimens.

The formation of secondary fruits within the ovary is evidently not uncommon in the papaya, and has been observed by many persons. It is said that in some instances the intra-ovarial fruits are exact models in miniature of the normal fruits. No information was obtained as to whether or not such fruits have a seed cavity with ovules or seeds.

An instance of the formation, in a different manner, of a secondary pistil within the seed cavity has also been observed. In this case the secondary fruit, instead of arising from the placenta in place of an ovule, occurred as a proliferation of the vascular axis which extends from the pedicel through the pericarp (fig. 6). The form of the pistil is not representative of the normal form in pistillate flowers, but is of the type that is to be found in a petunia or other similar flower. On cutting the ovary transversely it was found that no seed cavity was present. A single vascular strand was located in the center.

MASTERS refers to intra-carpellary proliferation and states that "it occurs most frequently in plants having a free central placenta, though it is not confined to them, as it is recorded among Boraginaceae." No instance is cited, however, of a proliferation of the form here described.

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